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Electronic Energy Band Structure of Solids

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The study of the high-field magnetoresistance of reduced $SrTiO_3$ has been brought to a satisfactory conclusion. A total of 6 days (between October, 1965, and June, 1966) was spent at the Naval Research Laboratory measuring three samples in the temperature range 1.4 - 4.2°K in fields up to 150 kOe. These measurements were made in cooperation with Dr. Julius Babiskin and Mr. P. G. Siebenman of the NRL staff. Most of the investigation involved recording the change of resistance $\Delta\rho/\rho$ in longitudinal magnetic fields. Samples with length directions along the <100>, <110> and <111> crystal axes were used. In the last run (June 2, 1966) a <110> sample was rotated in the magnetic field which yielded $\Delta\rho/\rho$ (long. or transv.) for all 3 directions measured on one and the same sample.

Analysis of the data confirms the theoretical picture of ellipsoidal energy surfaces along the <100> axes.[1] It proves unambiguously that the minimum of the ellipsoids occurs at the edge (3 ellipsoids rather than 6).

The ratio K of the longitudinal and transverse masses varies between 1.9 and 5.0 ($K_{av} = 3.4$). Combining these results with a density-of-states effective mass of 5.0,[2-4] one finds for the absolute values: $m_t = 1.6 \pm 15\%$, and $m_\ell = 5.5 \pm 30\%$. These figures are in excellent agreement with the low-field magnetoresistance data and are also close to Barker's results.[5]

Measurements of the resistivity of Nb- and La-doped $SrTiO_3$ are being extended to $\sim$ 1200°K in order to explore the electron scattering mechanism.

A paper reviewing the band structure of $SrTiO_3$ will be presented at the International Conference on The Physics of Semiconductors in September, 1966 (at Kyoto, Japan).

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